

Claims

1. A method of transmitting data signals in a synchronous mode over a telephone landline, a wireless radio frequency network or a cellular telephone system from a sending modem to a receiving modem without incurring errors in the transmitted data signals from loss of carrier or a noisy transmission environment by using a modified network protocol, said method comprising the steps of:
- auto selecting of either landline, radio frequency transceivers or cellular telephone transceiver operation;
  - connecting between the sending modem and the receiving modem;
  - establishing desired communication configuration between the sending modem and the receiving modem through handshaking;
  - determining presence of carrier from receiving modem;
  - terminating the connection between the sending modem and the receiving modem if a predetermined time has elapsed without determining presence of carrier;
  - interrogating the receiving modem by sending appropriate link-connect packet from the sending modem if presence of carrier is determined;
  - determining if a correct link-connect packet is received at the sending modem from the receiving modem; and
  - determining that the modified network protocol connection between the sending modem and the

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receiving modem is successful if a correct link-connect packet is received at the sending modem from the receiving modem.

- 5     2.    The method according to Claim 1 further including the steps of:

retrying to interrogate the receiving modem a predetermined number of retry counts if the correct link-connect packet is not received from the receiving modem;

10       choosing between one of two possible modes if not successful in interrogating the receiving modem in the predetermined number of retry counts, and the two possible modes being line disconnect and a network protocol, other than  
15       the modified network protocol, operating mode.

3.    The method according to claim 2 wherein said predetermined number of retry counts is equal to six.

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4.    The method according to claim 1 further including the steps of:

determining the presence of carrier from receiving modem;

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switching to asynchronous mode if presence of carrier is not determined and then switching to synchronous mode when presence of carrier is determined;

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readying data packet for transmission to recitation modem when carrier is present;  
transmitting data packet to receiving modem;  
receiving positive acknowledgement from receiving modem; and

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repeating the five steps set forth above until a positive acknowledgement is not received from the receiving modem.

- 5     5.     The method according to Claim 4 further including the steps of:

checking if the retransmission timer has elapsed if positive acknowledgement has not been received from the receiving modem;

- 10     checking if a negative a negative acknowledgement has been received from the receiving modem if the retransmission timer has not elapsed;

retransmitting the data packet to the receiving modem if a negative acknowledgement has been received from the receiving modem;

15     repeating the three steps set forth above until positive acknowledgement is received form the receiving modem or until the retransmission count reaches a predetermined number; and

20     initiating a disconnect sequence if the retransmission count reaches said predetermined number before a positive acknowledgement is received form the receiving modem.

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6.     The method according to claim 5 wherein said retransmission count is eighteen.

- 30     7.     The method according to Claim 4 further including the steps of:

checking if the retransmission timer has elapsed if a positive acknowledgement has not been received from the receiving modem;

retransmitting the data packet to the receiving  
modem if the retransmission timer has elapsed;  
repeating the two steps set forth above until  
positive acknowledgement is received from the  
receiving modem or until the retransmission  
count reaches a predetermined number; and  
initiating a disconnect sequence if the  
retransmission count reaches said  
predetermined number before a positive  
acknowledgement is receiving from the  
receiving modem.

8. The method according to Claim 7 wherein said  
retransmission count is eighteen.

9. A modem for transmitting data signals in a  
synchronous mode over a telephone landline or a cellular  
telephone system without incurring errors in the  
transmitted data signals from loss of carrier or a noisy  
transmission environment and for transmitting voice  
signals over the telephone landline or the cellular  
telephone system, comprising:

a modem for converting received digital signals to  
analog signals and for converting received  
analog signals to digital signals;

a data access arrangement operatively connected to  
said modem and including means to operatively  
connect to the telephone landline;

a microcontroller operatively connected to said  
modem;

a read-only-memory operatively connected to said  
microcontroller;

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protocol software in said read-only-memory in the form of firmware for controlling the operation of the modem;

cellular telephone interface means for connecting said microcontroller to a control unit and a transceiver unit of the cellular telephone;

a voice board means for providing hands free communications over the telephone landline or the cellular telephone system;

first analog switch for receiving input from said voice board means and providing outputs to said data access arrangement and said transceiver unit of said cellular telephone;

second analog switch for receiving input from said control unit of said cellular telephone and providing outputs to said data access arrangement and said transceiver unit of said cellular telephone;

third analog switch for receiving input from said modem and providing outputs to said data access arrangement and said transceiver unit of said cellular telephone; and

means to connect data terminal equipment to said microcontroller through an interface.

10. The modem of claim 9 wherein said protocol software includes means for retrying the connection phase for a total of six tries.

11. The modem of claim 10 wherein said protocol software includes means for retransmitting data packets, after successful connection phase, for a total of eighteen tries.

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12. The modem of claim 11 wherein said protocol software includes means to suspend transmission from the modem to wait for the recovery of loss of carrier.

5 13. The modem of claim 12 wherein said protocol software includes means to switch the mode of operation of said modem from synchronous to asynchronous if carrier loss occurs during transmission in the synchronous mode of operation and to switch back to the  
10 synchronous mode upon recovery of the carrier.

14. A modem for transmission data signals in a synchronous mode over a telephone landline, a wireless radio frequency network or a cellular telephone system without incurring errors in the transmitted data signals from a loss of carrier or a noisy transmission environment and for transmitting voice signals over the telephone landline, a wireless radio frequency network or a cellular telephone system, comprising:

20 a modem for converting received digital signals to analog signals and for converting received analog to digital signals;

a data access arrangement operatively connected to said modem and including a means to

25 operatively connect to the telephone landline;  
a microcontroller operatively connected to said modem;

a read-only-memory operatively connected to said microcontroller;

30 protocol software in said read-only-memory in the form of firmware for controlling the operation of the modem;

cellular telephone interface means for connected  
said microcontroller to a cellular telephone  
transceiver unit;

5 radio frequency radio interface/logic board means  
for connected said microcontroller to a radio  
frequency transceiver unit;

a voice board means for providing hands-free  
communication using a microphone and speaker  
over a telephone landline, a wireless radio  
10 frequency network or a cellular telephone  
system;

analog switch means for receiving inputs from said  
voice board means, said radio frequency  
transceiver, said cellular telephone  
15 transceiver and said modem and providing  
outputs to said data access arrangement, said  
radio frequency transceiver, and said  
cellular telephone transceiver; and  
means to connect data terminal equipment to said  
20 microcontroller through an interface.

2.  
15. The modem of claim 14 wherein said protocol software  
includes means for retrying the connection phase for a  
said number of tries.

25 3.  
16. The modem of claim 15 wherein said protocol software  
includes means for retransmitting data packets, after  
successful connection phase, for a said number of tries.

30 4.  
17. The modem of claim 16 wherein said protocol software  
includes means to suspend transmission from the modem to  
wait for the recovery of loss of carrier.

5.  
18. The modem of claim 17 wherein said protocol software includes means to switch the mode of operation of said modem from synchronous to asynchronous if carrier loss occurs during transmission in the synchronous mode of operation and to switch back to the synchronous mode upon recovery of the carrier.

6.  
19. A method and apparatus for the auto-selecting and auto-routing of either data or voice communication over a cellular telephone system, a radio frequency network, telephone line service or a combination of communication services from a sending modem-controller to a receiving modem, using an enhanced version of (MNP) protocol called the ITC Reliable Mode (ITC-RM), said method comprising the steps of:

analog switching to receive voice signals and data signals from a plurality of different predetermined input sources and to route the received voice signals and data signals to different predetermined selectable destinations;

automatically connecting between the sending modem-controller and the receiving modem over a cellular telephone system, radio frequency network or a telephone line service;

establishing desired communication configuration between the sending modem-controller and the receiving modem through handshaking over a cellular telephone system, radio frequency network or a telephone line service;

determining presence of carrier from receiving modem over a cellular telephone system, radio frequency network or a telephone line service;



terminating the connection between the sending  
modem-controller and the receiving modem if a  
predetermined time has elapsed without  
determining presence of carrier over a  
cellular telephone system, radio frequency  
network or a telephone line service;

interrogating the receiving modem by sending  
appropriate link-connect packet from the  
sending modem-controller if presence of  
carrier is determined over a cellular  
telephone system, radio frequency network or  
a telephone line service;

determining if a correct link-connect packet is  
received at the sending modem-controller from  
the receiving modem over a cellular telephone  
system, radio frequency network or a  
telephone line service; and

determining that the modified network protocol  
connection between the sending  
modem-controller and the receiving modem is  
successful if a correct link-connect packet is  
received at the sending modem-controller from  
the receiving modem over a cellular telephone  
system, radio frequency network or a  
telephone line service.

1.  
~~20.~~ The method according to claim ~~19~~<sup>6</sup> further including  
the steps of:

retrying to interrogate the receiving modem a  
predetermined number of retry counts if the  
correct link-connect packet is not received  
from the receiving modem over a cellular  
telephone system, radio frequency network or  
a telephone line service;

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choosing between one of two possible modes if not  
successful in interrogating the receiving modem  
in the predetermined number of retry counts,  
said two possible modes being line disconnect  
or non-microcom networking protocol and a  
networking protocol, other than the microcom  
networking protocol operating mode over a  
cellular telephone system, radio frequency  
network or a telephone line service.

8.  
21. The method according to claim 20<sup>7</sup> wherein said  
predetermined number of retry counts is equal to six  
over a cellular telephone system, radio frequency  
network or a telephone line service.

9.  
22. The method according to claim 19<sup>6</sup> further including  
the steps of:

determining the presence of carrier from receiving  
modem over a cellular telephone system, radio  
frequency network or a telephone line service;  
automatically switching to asynchronous mode if  
presence of carrier is not determined and then  
switching to synchronous mode when presence of  
carrier is determined over a cellular telephone  
system, radio frequency network or a telephone  
line service;

readying data packet for transmission to recitation  
modem when carrier is present over a cellular  
telephone system, radio frequency network or a  
telephone line service;

transmitting data packet to receiving modem over a  
cellular telephone system, radio frequency  
network or a telephone line service;

receiving positive acknowledgement from receiving  
modem over a cellular telephone system, radio  
frequency network or a telephone line service;  
and

5 automatically repeating the five steps set forth  
above until a positive acknowledgement is not  
received from the receiving modem over a  
cellular telephone system, radio frequency  
network or a telephone line service.

10 <sup>10</sup>  
~~23~~. The method according to Claim <sup>9</sup>~~22~~ further including  
the steps of:

checking if the retransmission timer has elapsed if  
a positive acknowledgement has not been  
15 received from the receiving modem over a  
cellular telephone system, radio frequency  
network or a telephone line service;

checking if a negative a negative acknowledgement  
has been received from the receiving modem if  
20 the retransmission timer has not elapsed over a  
cellular telephone system, radio frequency  
network or a telephone line service;

retransmitting the data packet to the receiving  
modem if a negative acknowledgement has been  
25 received from the receiving modem over a  
cellular telephone system, radio frequency  
network or a telephone line service;

30 automatically repeating the three steps set forth  
above until positive acknowledgement is  
received from the receiving modem or until the  
retransmission count reaches a predetermined  
number over a cellular telephone system, radio

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frequency network or a telephone line service;  
and

initiating a disconnect sequence if the  
retransmission count reaches said predetermined  
number before a positive acknowledgement is  
received from the receiving modem over a  
cellular telephone system, radio frequency  
network or a telephone line service.

11. 10  
24. The method according to claim 23 wherein said  
retransmission count is eighteen.

12. 9  
25. The method according to Claim 22 further including  
the steps of:  
15 checking if the retransmission timer has elapsed if  
a positive acknowledgement has not been  
received from the receiving modem over a  
cellular telephone system, radio frequency  
network or a telephone line service;  
20 retransmitting the data packet to the receiving  
modem if the retransmission timer has elapsed  
over a cellular telephone system, radio  
frequency network or a telephone line service;  
25 automatically repeating the two steps set forth  
above until positive acknowledgement is  
received from the receiving modem or until the  
retransmission count reaches a predetermined  
number over a cellular telephone system, radio  
frequency network or a telephone line service;  
30 and  
initiating a disconnect sequence if the  
retransmission count reaches said predetermined  
number before a positive acknowledgement is

receiving from the receiving modem over a cellular telephone system, radio frequency network or a telephone line service.

5 <sup>13.</sup>  
~~26.~~ The method according to Claim <sup>12</sup>~~25~~ wherein said retransmission count is eighteen.

<sup>14.</sup>  
10 ~~27.~~ A modem-controller for transmission data signals in a synchronous mode over ordinary telephone line service, radio frequency network or a cellular telephone system without incurring errors in the transmitted data signals from a loss of carrier or a noisy transmission environment and for transmitting voice signals over telephone line service, radio frequency networks and  
15 cellular telephone systems, comprising:  
a modem for converting received digital signals to analog signals and for converting received analog to digital signals;  
a data access arrangement operatively connected to  
20 said modem and including a means to operatively connect to a telephone line;  
a microcontroller operatively connected to said modem;  
a read-only-memory operatively connected to said  
25 microcontroller;  
protocol software in said read-only-memory in the form of firmware for controlling the operation of the modem-controller;  
cellular telephone interface means for connected  
30 said microcontroller to a cellular telephone unit;

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radio frequency radio interface/logic board means  
for connected said microcontroller to radio  
frequency telemetry modules or packet radios;

a voice board means for providing hands-free  
communication using a microphone and speaker  
over a telephone line, a wireless radio  
frequency network or a cellular telephone  
system;

analog switch means for receiving inputs from said  
voice board means, said radio frequency  
telemetry modules or packet radios, said  
cellular telephone and said modem-controller  
and providing outputs to said modem, data  
access arrangement, said radio frequency  
telemetry modules or packet radios, and said  
cellular telephone;

first analog switch for receiving input from said  
voice board means or said modem and providing  
outputs to second analog switch;

second analog switch for receiving input from first  
analog switch and providing outputs to said  
data access arrangement or radio frequency  
radio interface/logic board;

third analog switch for receiving input from said  
data access arrangement and providing outputs  
to said cellular telephone interface to said  
cellular telephone;

fourth analog switch for receiving input from said  
data access arrangement and providing outputs  
to said telephone line;

fifth analog switch for receiving input from  
telephone line and providing outputs to said

cellular telephone interface to said cellular telephone; and

means to connect data terminal equipment to said microcontroller through an interface.

5     <sup>15</sup>  
28. The modem-controller of claim <sup>14</sup>27 wherein said  
protocol software includes means for retrying the  
connection phase for a total of six tries over a cellular  
telephone system, radio frequency network or a telephone  
10    line service.

16  
29. The modem-controller of claim <sup>15</sup>28 wherein said  
protocol software includes means for retransmitting data  
packets, after successful connection phase, for a total  
15    of eighteen tries over a cellular telephone system, radio  
frequency network or a telephone line service.

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30. The modem-controller of claim <sup>16</sup>29 wherein said  
protocol software includes means to suspend transmission  
20    from the modem-controller to wait for the recovery of  
loss of carrier over a cellular telephone system, radio  
frequency network or a telephone line service.

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31. The modem-controller of claim <sup>17</sup>30 wherein said  
protocol software includes means to switch the mode of  
operation of said modem-controller from synchronous to  
asynchronous if carrier loss occurs during transmission  
in the synchronous mode of operation and to switch back  
25    to the synchronous mode upon recovery of the carrier over  
a cellular telephone system, radio frequency network or  
30    a telephone line service.

19.

32. The present invention relates in general to the control, transmission and reception of standard data, fax data and voice signals. More particularly, but not by way of limitation, it relates to a distinct method and apparatus for the auto-selecting and auto-routing of either standard data, fax data or voice communication over a cellular telephone system, a radio frequency network, satellite system, telephone line service or a combination of communication services. The invention may be installed internally in computers or data terminal equipment to communicate with any other computers or data terminal equipment; directly through the computers or data terminal equipment or used as a stand alone method and apparatus; connected externally to computers or data terminal equipment. More particularly, but not by way of limitation, using an enhanced and fine tuned version of (MNP) protocol called the ITC Reliable Mode (ITC-RM), it relates to a method and apparatus for transmission of standard data, fax data and voice over a cellular telephone system, radio frequency network, satellite system or a telephone line service with emphasis upon the error-free transmission and reception of standard data and fax data in an error correcting mode, said method comprising the steps of:

analog switching means structured to receive voice signals and

standard or fax data signals from a plurality of different predetermined input sources and to route the received voice signals and standard or fax data signals to different predetermined selectable destinations, said routing being determined by control signals received by said analog switching means;



automatic connecting between the sending  
modem-controller and the  
receiving modem over a cellular telephone system,  
radio frequency network, satellite system or a  
telephone line service;

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establishing desired communication configuration  
between the sending modem-controller and the  
receiving modem through handshaking over a  
cellular telephone system, radio frequency-  
network, satellite system or a telephone line  
service;

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determining presence of carrier from receiving modem  
over a cellular telephone system, radio  
frequency network, satellite system or a  
telephone line service;

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terminating the connection between the sending  
modem-controller and the receiving modem if a  
predetermined time has elapsed without  
determining presence of carrier over a cellular  
telephone system, radio frequency network,  
satellite system or a telephone line service;

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interrogating the receiving modem by sending  
appropriate link-connect packet from the  
sending modem-controller if presence of carrier  
is determined over a cellular telephone system,  
radio frequency network, satellite system or a  
telephone line service;

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determining if a correct link-connect packet is  
received at the sending modem-controller from  
the receiving modem over a cellular telephone  
system, radio frequency network, satellite  
system or a telephone line service; and

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determining that the modified network protocol connection between the sending modem-controller and the receiving modem is successful if a correct link-connect packet is received at the sending modem-controller from the receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

5  
10 <sup>20</sup>  
~~33~~. The method according to claim <sup>19</sup>~~32~~ further including the steps of:

15        retrying to interrogate the receiving modem a predetermined number of retry counts if the correct link-connect packet is not received from the receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service;  
20        choosing between one of two possible modes if not successful in interrogating the receiving modem in the predetermined number of retry counts, said two possible modes being line disconnect or non-microcom networking protocol and a networking protocol, other than the microcom networking protocol operating mode over a  
25        cellular telephone system, radio frequency network, satellite system or a telephone line service.

30 <sup>21</sup>  
~~34~~. The method according to claim <sup>26</sup>~~33~~ wherein said predetermined number of retry counts is equal to six over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

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<sup>22</sup>  
~~35~~. The method according to claim <sup>19</sup>~~32~~ further including the steps of:

determining the presence of carrier from receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

automatic switching to asynchronous mode if presence of carrier is not determined and then switching to synchronous mode when presence of carrier is determined over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

readying a standard or fax data packet for transmission to recitation modem when carrier is present over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

transmitting a standard or fax data packet to receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

receiving positive acknowledgement from receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service; and

automatically repeating the five steps set forth above until a positive acknowledgement is not received from the receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

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23. 36. The method according to Claim 35 further including the steps of:

5 checking if the retransmission timer has elapsed if a positive acknowledgement has not been received from the receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

10 checking if a negative a negative acknowledgement has been received from the receiving modem if the retransmission timer has not elapsed over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

15 retransmitting the standard or fax data packet to the receiving modem if a negative acknowledgement has been received from the receiving modem over a cellular telephone system, radio frequency network, satellite system or a telephone line service;

20 automatically repeating the three steps set forth above until positive acknowledgement is received form the receiving modem or until the retransmission count reaches a predetermined number over a cellular telephone system, radio frequency network, satellite system or a telephone line service; and

25 initiating a disconnect sequence if the retransmission count reaches said predetermined number before a positive acknowledgement is received form the receiving modem over a cellular telephone system, radio frequency

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network, satellite system or a telephone line service.

24  
37. The method according to claim 23 wherein said  
5 retransmission count is eighteen.

25  
38. The method according to Claim 22 further including  
the steps of:

10 checking if the retransmission timer has elapsed if  
a positive acknowledgement has not been  
received from the receiving modem over a  
cellular telephone system, radio frequency  
network, satellite system or a telephone line  
service;  
15 retransmitting the standard or fax data packet to  
the receiving modem if the retransmission timer  
has elapsed over a cellular telephone system,  
radio frequency network, satellite system or a  
telephone line service;  
20 automatically repeating the two steps set forth  
above until positive acknowledgement is  
received from the receiving modem or until the  
retransmission count reaches a predetermined  
number over a cellular telephone system, radio  
25 frequency network, satellite system or a  
telephone line service; and  
initiating a disconnect sequence if the  
retransmission count reaches said predetermined  
number before a positive acknowledgement is  
30 receiving from the receiving modem over a  
cellular telephone system, radio frequency  
network, satellite system or a telephone line  
service.

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<sup>26</sup>  
39. The method according to Claim <sup>25</sup>38 wherein said retransmission count is eighteen.

- <sup>27</sup>  
40. A modem-controller for transmission of standard or fax data signals in a synchronous mode over ordinary telephone line service, radio frequency network, satellite system or a cellular telephone system without incurring errors in the transmitted standard or fax data signals from a loss of carrier or a noisy transmission environment and for transmitting voice signals over telephone line service, radio frequency networks and cellular telephone systems, comprising:
- a modem for converting received digital signals to analog signals and for converting received analog to digital signals;
  - a data access arrangement operatively connected to said modem and including a means to operatively connect to a telephone line;
  - a microcontroller operatively connected to said modem;
  - a read-only-memory operatively connected to said microcontroller;
  - protocol software in said read-only-memory in the form of firmware for controlling the operation of the modem-controller;
  - cellular telephone interface means for connecting said microcontroller to a cellular telephone unit;
  - radio frequency radio interface means for connecting said microcontroller to a radio frequency telemetry module or packet radio unit;

a voice board means for providing hands-free communication using a microphone and speaker over a telephone line, a wireless radio frequency network, satellite system or a cellular telephone system;

analog switch means controlled by said microprocessor to control input and output of said voice board means or said data pump means to said radio frequency radio means and to said data access arrangement means to said cellular telephone means, said satellite system means and a remote device or infrared transceiver;

first analog switch for receiving input from said microprocessor means to control signal path from said voice board means or said data pump means to said radio frequency or data access arrangement select analog switch means;

second analog switch for receiving input from said microprocessor means to control signal path from said voice/modem select switch means to said radio frequency radio interface/logic board means radio or said data access arrangement;

third analog switch for receiving input from said data microprocessor means to control signal path from said data access arrangement to said cellular telephone interface to said cellular telephone;

fourth analog switch for receiving input from said microprocessor means to control signal path from said data access arrangement to a remote device or infrared transceiver through said telephone line or to said satellite system;

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fifth analog switch for receiving input from said microprocessor means to control signal path from said remote device or infrared transceiver via said telephone line connected to said cellular telephone interface to said cellular telephone; and

means to connect said data terminal equipment to said microcontroller through said interface.

28.  
41. The modem-controller of claim 27 wherein said protocol software includes means for retrying the connection phase for a total of six tries over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

29.  
42. The modem-controller of claim 28 wherein said protocol software includes means for retransmitting data packets, after successful connection phase, for a total of eighteen tries over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

30.  
43. The modem-controller of claim 29 wherein said protocol software includes means to suspend transmission from the modem-controller to wait for the recovery of loss of carrier over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

31.  
44. The modem-controller of claim 30 wherein said protocol software includes means to switch the mode of operation of said modem-controller from synchronous to asynchronous if carrier loss occurs during transmission

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in the synchronous mode of operation and to switch back to the synchronous mode upon recovery of the carrier over a cellular telephone system, radio frequency network, satellite system or a telephone line service.

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